A DESCRIPTION OF THE Corn Mill ON Concord River

belonging to the PROPRIETORS OF MIDDLESEX CANAL, with a calculation of its

POWERS and VELOCITIES.

Fig. 3.

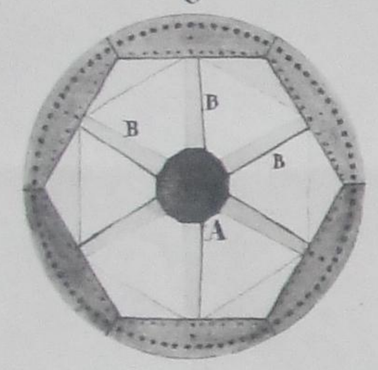


Fig. 1.

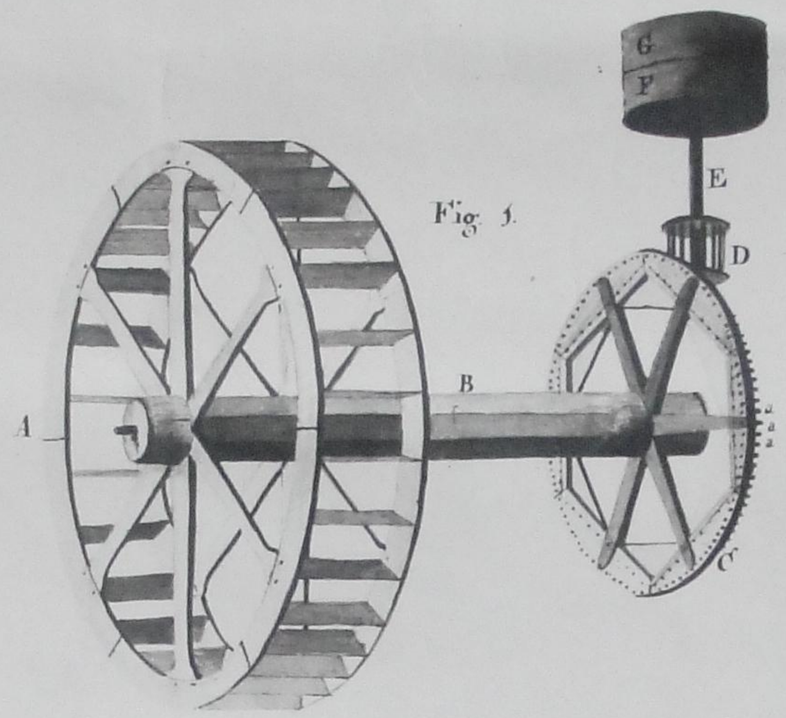


Fig. 2.

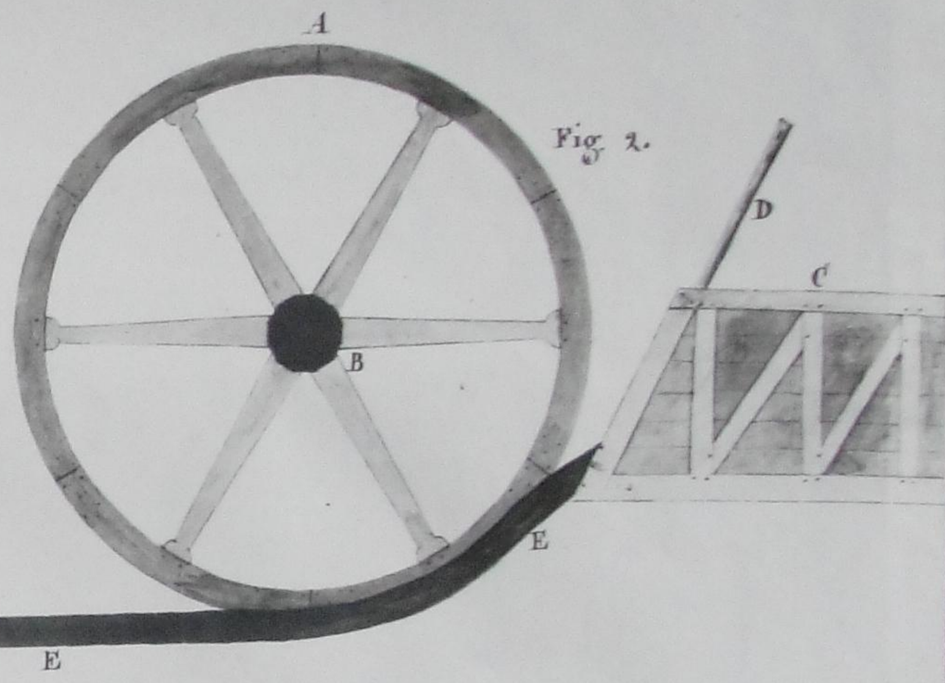


Fig. 4.

Fig. 5.

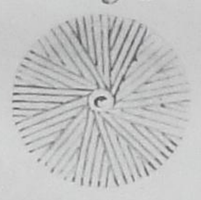
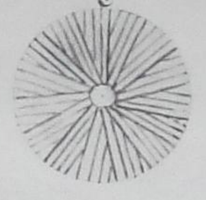


Fig. 6.



Explanation of the Figures.

Fig. 1. Represents the machinery of a single geared Corn Mill, in perspective, drawn without any supports, to render the view more distinct. **A** is the water wheel, **B** the shaft, **C** the cog-wheel, of which, part of the cogs are seen at **a a a**, **D** the trundle head, **E** the shank which connects the upper mill stone with the trundle head, **F** the bed stone, and **G** the runner, or upper mill stone.

Fig. 2. Represents a side view of water wheel at **A** and of the shaft cut at right angles with its axis **B.** This wheel has 6 arms and 30 floats. **C** is a side view of the penstock which has 6 feet of water. **D** the gate. **EE** is a side view of the apron through which water escapes from the wheel. The diameter of the wheel = 16 feet.

Fig. 3. Represents the face of the cog-wheel which has 6 arms and 84 cogs. **A** represents the shaft cut perpendicular to its axis. **B,B,B,** etc. are the arms of the cog-wheel. The diameter of the wheel is 10 F; The pitch circle is 9 F, 4 in.

Fig. 4. Represents one end of the trundle head, which has 16 rounds, 2 F, 4 in, in diameter, the rounds 1 F, 4 in, long and the pitch circle is 1 F, 9 in, in diameter.

Fig. 5. Represents the face of the bed stone, 4 F, 10 in, in diameter. It has 13 land furrows and 4 streaks in each furrow. The diameter of the eye is 9 in.

Fig. 6. Represents the face of the runner, 4 10 in diameter. It has 15 land furrows and 3 streaks in each furrow. The diameter of the eye is 9 in. Its estimated weight is 50, Cwt.

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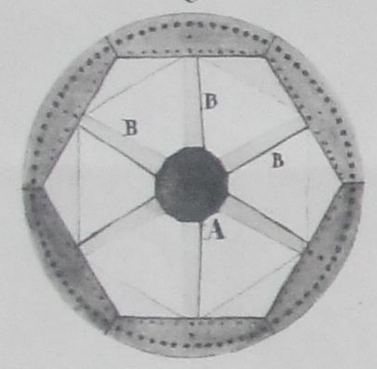

Fig. 4.

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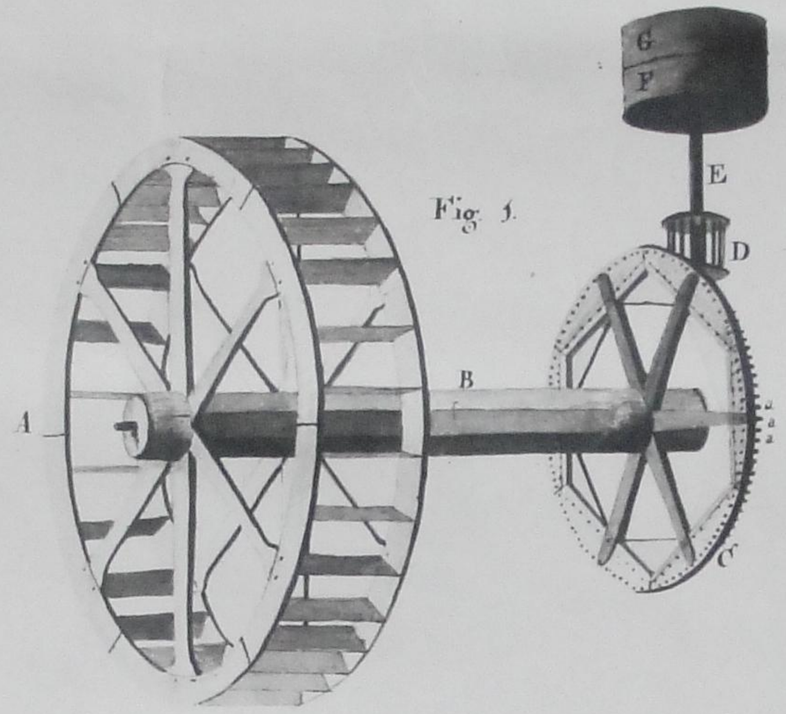


Fig. 2.

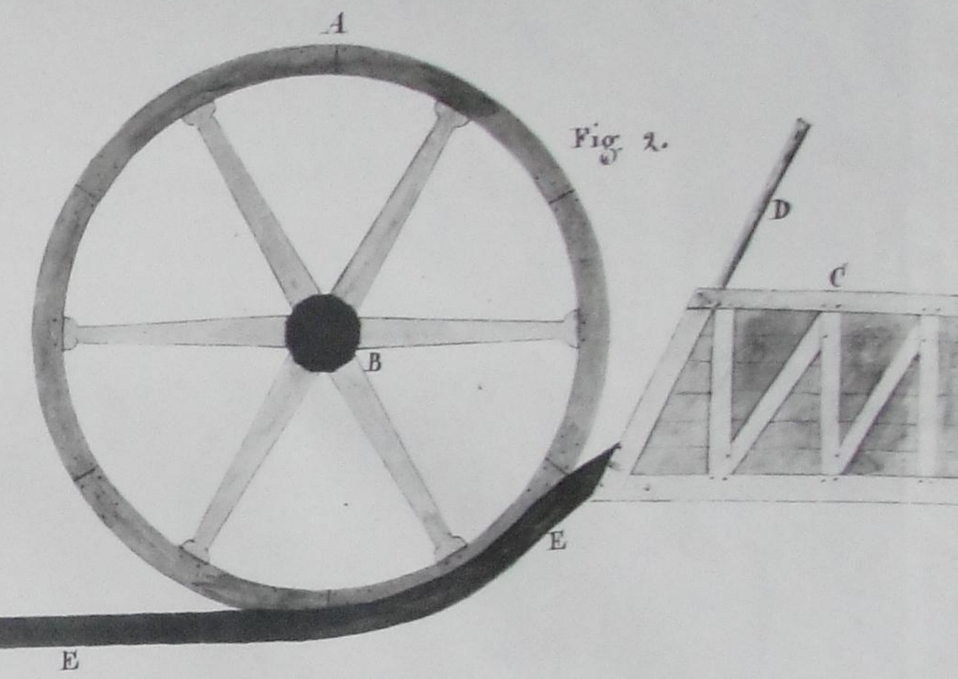
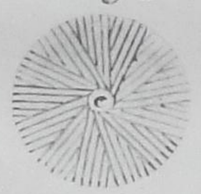


Fig. 5.



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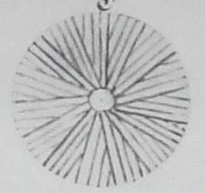

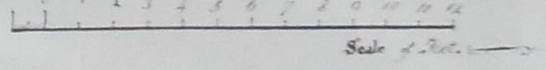

Scale of Feet.

Explanation of the Figures.

Fig. 1. Represents the machinery of a single pair of Corn Mill, in perspective, drawn without any supports to render the view more distinct. A is the water wheel B the shaft. C the cog-wheel, of which, part of the cogs are seen at aaa. D the trundle head E the shank which connects the upper mill stone with the trundle head. F the bed stone and G the runner, or upper mill stone.

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Fig. 3. Represents the face of the cog-wheel which has 6 arms and 84 cogs. A represents the shaft cut perpendicular to its axis. B B B &c. are the arms of the cog wheel. The diameter of the wheel is $10^{F.}$ The pitch circle is $9^{F.}\ 6^{in.}$

Fig. 4. Represents one end of the trundle head which has 10 rounds, $2^{F.}\ 4^{in.}$ in diameter. the rounds $1^{F.}\ 4^{in.}$ long and the pitch circle is $1^{F.}\ 9^{in.}$ in diameter.

Fig. 5. Represents the face of the bed stone $4^{F.}\ 10^{in.}$ in diameter. It has 13 land furrows and 4 shocks in each furrow. The diameter of the eye e is $9^{in.}$

Fig. 6. Represents the face of the runner. 4. 10 in diameter. It has 15 land furrows and 3 shocks in each furrow. The diameter of the eye is $9^{in.}$ Its estimated weight is 550 lbs.

CALCULATIONS.

Problem I.

To find the velocity of water issuing from a $5\frac{4}{12}$ head.

As the square root of 4 ... = 2
Is to the velocity per second. ... = 16, 2
So is the square root of $5\frac{4}{12}$ ... = 2, 3
To the velocity required ... = 18, 63

Problem II.

To find the quantity of water expended per second.

The velocity of the water per second ... = 18, 63
Multiplied by the area of the gate ... = 2.
Gives the cubic feet expended per second ... = 37, 26

Problem III.

To determine the force exerted upon the circumference of the water wheel.

Multiply the cubic feet expended per second ... = 37, 26
By the virtual perpendicular descent ... = 3, 3
Gives the true measure of power per second in cubic feet ... = 122, 958

Problem IV.

To find the velocity of the water wheel per second.

As ... = 1000
Is to ... = 577
So is the velocity of the water per second ... = 18, 63
To the velocity required ... = 10, 749

Problem V.

To find the velocity of the pitch circle of the cog wheel per second.

As radius of the water wheel ... = 8
Is to its velocity per second ... = 10, 749
So is radius of the pitch circle of cog wheel ... = 4, 66
To the velocity required ... = 6, 26127

Problem VI

To find the velocity of the stone at the circumference.

As radius of the pitch circle of the trundle head ... = ,833
Is to its velocity = that of the cog wheel ... = 6, 26127
So is radius of the stone ... = 2, 5
To the velocity required ... = 18, 791

Problem IX.

To determine the size of the stones which will best suit the power of the given seat.

Divide the power ... = 122, 958
By ... = 6
And we have the area of the stone ... = 20, 493
To which add one for the eye ... = 21, 493
Divide by ... = ,7854
And the quotient is the square of the diameter ... = 16, 631630 4
The square root of which is the diameter required ... = 4, 25+ which very nearly agrees with the theory.

Problem X.

To find how many revolutions the water wheel performs per minute.

As ... = 113
Is to ... = 355
So is circumference of the water wheel ... = 16
To circumference of the same ... = 50, 265 +

Then

The velocity of the wheel per second ... = 18, 63
Multiplied by the seconds in a minute ... = 60
Gives the velocity of the wheel per minute ... = 1117, 80
Which divided by the circumference ... = 50, 265 +
Gives the revolutions required ... = 22, 223 +

Problem II.

To find the number of revolution of the trundle head to one of the cog wheel.

Divide the number of cogs in the cog wheel ——— = 84
By the number of rounds in the trundle head ——— = 16
And the quotient gives the answer ——— = 5, 25

In this example the number of rounds will not divide the cogs without a remainder. Then,

Problem III.

To find how often they will both revolve before the same cogs and rounds meet again.

Divide the number of cogs ——— = 84
By the rounds, as above ——— = 16
And with the remainder, after the division ——— = 4
Divide the number of rounds ——— = 16
And the quotient is the number of revolutions of cog wheel = 4
before the same cogs will meet the same rounds.

N.B. The velocity of the trundle head is the same as that of the cog wheel; for the teeth of the cog wheel taking into the rounds of the trundle head causes a point of the pitch circle in the latter to revolve with the same velocity as the former.

Problem XI.

To find how many revolutions the stone performs per minute.

As the diameter of a circle ——— = 113
Is to its circumference ——— = 355
So is diameter of the stone ——— = 4, 8
To its circumference ——— = 15, 07

Then

The velocity per second ——— = 18, 791
Multiplied by number of seconds in a minute ——— = 60
Gives the velocity per minute ——— = 1127, 460
Which divided by the circumference ——— = 15, 07
Gives the revolutions required. ——— = 74, 8

Problem XII.

To find the area of the under mill stone, passed over by a radial line of the runner, per minute.

Find the area of the stone without the eye. ——— = 22, 4489
Multiply by the revolutions per minute ——— = 74, 8
And the product is the answer required ——— = 1679. 17754

To Mr. Samuel Webber Hollis Professor of MATHEMATICS and EXPERIMENTAL PHILOSOPHY at HARVARD UNIVERSITY in Cambridge, Massachusetts,

this exercise in MECHANICS is respectfully DEDICATED by

Loammi Baldwin jun.r

H.C. 1800.